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**ENSO**

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3rd Quarter, 2010 Vol. 16, No. 3

ISSUED: July 31, 2010

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**A Quarterly Bulletin of the Pacific El Niño/Southern Oscillation Applications Climate (PEAC) Center  
Providing Information on Climate Variability for the U.S.-Affiliated Pacific Islands**

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### **CURRENT CONDITIONS**

During the first few months of 2010, El Niño conditions matured, and by the end of June 2010, the Pacific Basin was on the verge of entering La Niña. Most forecast agencies anticipate the La Niña will commence by the end of July or by early August, and will then last for the rest of the year. The weather patterns across Micronesia are already fully those that are expected for La Niña; for example, rainfall for the first half of 2010 was below normal at most locations in Micronesia (see Figures 1a and 1b), and strong easterly surface wind prevailed. Additional alterations to the weather patterns were observed that are typical during years that follow El Niño (regardless of whether the climate state enters La Niña or returns to ENSO-neutral); these include a substantial reduction of tropical cyclones in the western North Pacific basin and a near elimination of the normal monsoon trough in Micronesia. The weather in such a circulation pattern is best described as “tranquil”. Typhoon activity is shifted away from the region, the monsoon is inhibited, and extremes of heavy rainfall (e.g. more than 4 inches in 24 hours) are reduced. In American Samoa, the just-ended rainy season was wetter than normal. The dry season has now started there, and strong southeast trade winds have become established.

In the Hawaiian Islands, the recently completed October 2009 through April 2010 wet season, or “Hooilo”, ranks as the driest in the past thirty years, and one of the driest in the past 55 years. This is based on average of wet season rainfall rankings from seven reporting stations across the state with continuous records. The duration of extreme drought in the Hawaiian islands was approaching one year at the beginning of June, just as the summer dry season was getting underway.

Sea-level variation in the USAPI is sensitive to the ENSO cycle, with lower (higher) sea level typically observed during El Niño (La Niña) events. As compared to May 2010, the monthly mean sea-level in June 2010 recorded a rise in most of the north Pacific stations (i.e., Guam, Palau, Yap, and Pohnpei). The forecasted values of sea level for the forthcoming seasons indicate that sea lev-

els for most of the stations in the north Pacific are likely to continue rising. The maxima will also be higher than normal during this same time period. This will be due to prevailing stronger-than-average westerly wind anomalies in the vicinity of western and central tropical Pacific. Additionally, the Hawaiian stations are likely to be slightly elevated during this time. Forecasted values are supportive of borderline La Niña conditions, which recently appeared in mid-June.

The following comments from the latest **Drought Information Statement** were posted on the WFO Guam website and the PEAC website on June 24, 2010:

“Drought conditions are over for Micronesia and this is the final statement for this event...”

“Upper-level wind patterns favorable for producing rainfall across Micronesia are finally entrenched across the islands. Drought conditions are no longer expected for any of the Micronesian islands. Although some of the northern Marshall Islands and Saipan and Tinian should continue to conserve water until drinking water sources are partially recharged. Increased cloudiness and weakened trade winds should reduce the heat and dryness experienced over the last several months.”

“The earlier El Niño event has transitioned into an ENSO-neutral status. The climate prediction center has issued a La Niña watch, and La Niña conditions could develop in the next few weeks. If this occurs, it will minimize monsoon and tropical cyclone activity over Micronesia. In the meantime, islands west of 155 east longitude could see a few episodes of monsoon activity and early tropical cyclone development.”

“The El Niño-related drought was most severe for islands farthest north from the equator; especially the northern Marshall Islands and the Mariana Islands. Also, very dry conditions in February and early March damaged some of the subsistence food crops on many of the southern Micronesian islands, and some food shortages may still be occurring on some islands.”

## SEA SURFACE TEMPERATURES

During June 2010, sea surface temperature (SST) anomalies continued to decrease across the equatorial Pacific Ocean, with negative anomalies expanding across the central and eastern Pacific. The subsurface heat content (average temperatures in the upper 300m of the ocean) also remained below-average during the month. Enhanced convection persisted over Indonesia, while the area of suppressed convection strengthened and expanded westward over the western and central equatorial Pacific. Enhanced low-level easterly trade winds and anomalous upper-level westerly winds prevailed over the western and central equatorial Pacific. Collectively, these oceanic and atmospheric anomalies reflect developing La Niña conditions.

## SOUTHERN OSCILLATION INDEX

The 3-month average of the Southern Oscillation Index for the 2nd Quarter of 2010 was +0.7, with monthly values of +1.2, +0.8, and +0.1 for the months of April, May, and June 2010, respectively. The recent shift from negative SOI values to positive values during the first half of 2010 is consistent with a shift from El Niño to La Niña in the ENSO cycle.

Normally, positive SOI values in excess of +1.0 are associated with La Niña conditions, and negative SOI values below -1.0 are associated with El Niño conditions. Low SOI values suggest a weak coupling between the ocean and the atmosphere. The SOI is an index representing the normalized sea-level pressure difference between Darwin, Australia, and Tahiti, respectively.

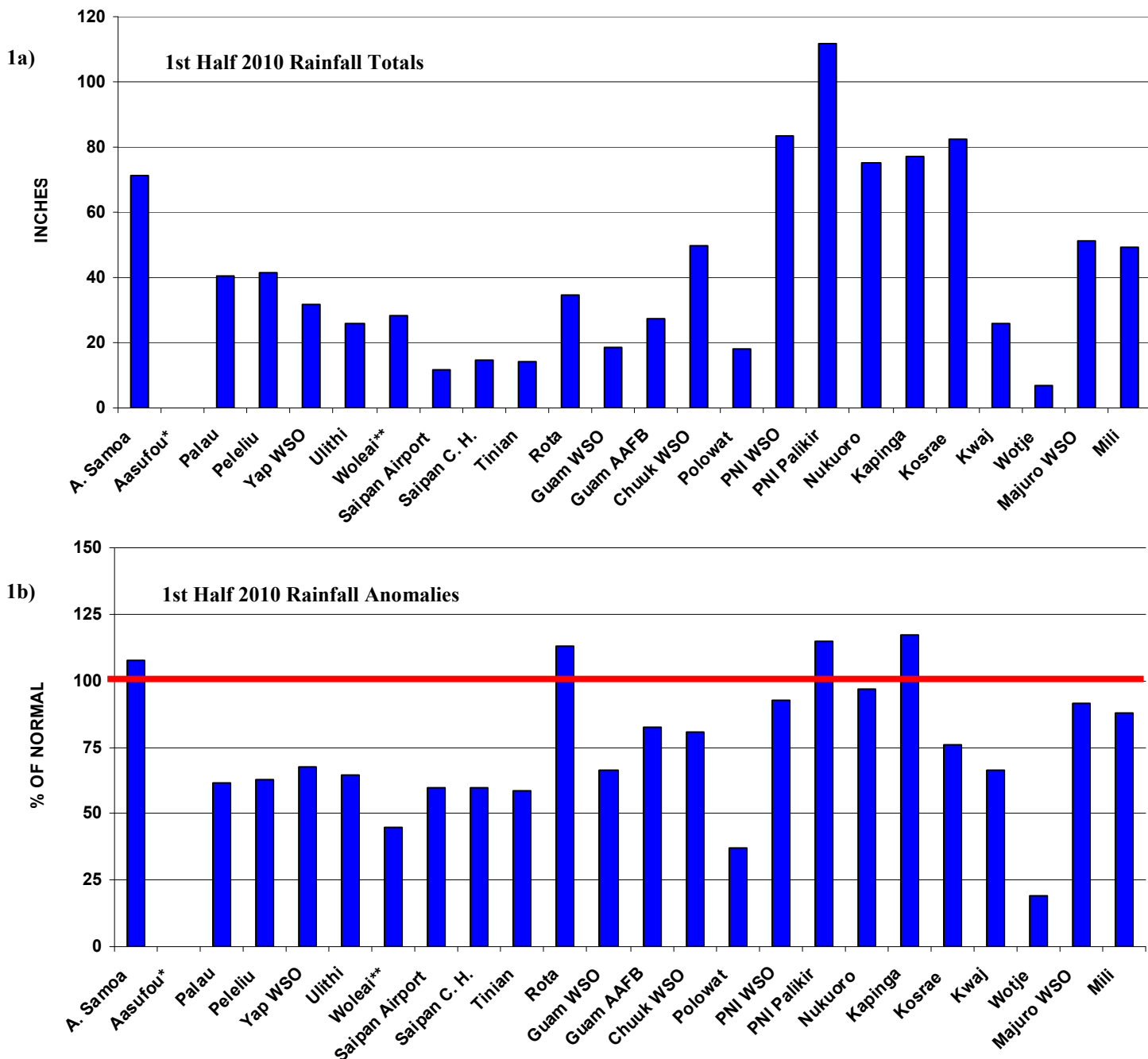


Figure 1, above. 1st Half 2010 rainfall totals (a) in inches and (b) anomalies (expressed as % of normal).

\*Aasofou data not available for JFM 2010. \*\*Estimated, Woleai data 19-30 June 2010 unavailable.

## TROPICAL CYCLONE

The PEAC archives western North Pacific tropical cyclone numbers, track coordinates, and 1-minute average maximum sustained wind taken from operational warnings issued by the Joint Typhoon Warning Center (JTWC) of the U. S. Air Force and Navy, located at Pearl Harbor, Hawai'i. Western North Pacific tropical cyclone names are obtained from warnings issued by the Japan Meteorological Agency (JMA), which is the World Meteorological Organization's Regional Specialized Meteorological Center (RSMC) for the western North Pacific basin. The PEAC archives South Pacific tropical cyclone names, track coordinates, central pressure, and 10-minute average maximum sustained wind estimates from advisories issued by the Tropical Cyclone Warning Centers at Brisbane, Nadi, and Wellington. The numbering scheme and the 1-minute average maximum sustained wind estimates are taken from warnings issued by the JTWC. There are sometimes differences in the statistics (e.g., storm maximum intensity) for a given tropical cyclone among the agencies that are noted in this summary.

**Tropical Cyclone Summary**

Continuing a nearly five-year trend of below normal tropical cyclone activity, the western North Pacific basin was very quiet during the first half of 2010. Only two cyclones were noted in the basin for the six-month period from January through June. The first cyclone of the year (occurring in January) was a tropical depression in the South China Sea. The second cyclone formed south of Guam in mid-April, and became Tropical Storm Omais as it passed near Ulithi on the 23rd of April. At the time of this writing (15 July) the first typhoon of the year, Typhoon Conson, had completed a crossing of Luzon. The timing of the year's first typhoon (which was also the third numbered tropical cyclone in the basin) put the 2010 season into the lowest 10% category for statistics of delay and reduction of TC numbers.

**PEAC Center Tropical Cyclone Outlook**

The PEAC tropical cyclone outlook<sup>1</sup> for the second half of 2010 (the heart of the typhoon season) calls for below normal tropical cyclone activity in the western North Pacific basin. A weather pattern of anomalous low-level easterly winds coupled with anomalous westerly winds in the upper troposphere has become established in the western Pacific basin, which is typical during La Niña. These conditions prevent the normal development of the monsoon trough, and inhibit tropical cyclone development. These conditions (present for all of the year 2008) have returned for 2010, and should continue to suppress cyclone activity in the basin for the remainder of the year. The suppression of cyclone activity will be most prominent from Guam eastward. Normally, there are four named cyclones passing within 180 nm of Guam. This year, there may be only one or two (half of normal). The western North Pacific basin is the world's most prolific generator of tropical cyclones, with a yearly average of 31 numbered cyclones (18 typhoons, 10 tropical storms and 3 tropical depressions). The number of tropical storms and typhoons in the basin during 2010 is anticipated to be reduced by 10-15% (a net loss of 4 or 5 named storms). Cyclone activity is likely to be shifted to the west and north (as in 2008), which reduces the number of named storms in Micronesia by a more pronounced amount than in the whole basin. Islands in the western half of Micronesia (e.g., Yap and Palau) will be the only places within Micronesia with a near normal threat of gales and other hazards (e.g., high waves) associated with tropical cyclones. Islands from Pohnpei and eastward into the Republic of the Marshall Islands experience tropical storms and typhoons primarily during El Niño. The risk of a damaging tropical cyclone in these locations is considered very low during 2010.

On 06 July, 2010, the TSR group released a forecast for below-normal TC activity in the western North Pacific for the 2010 season (a net loss of 2 typhoons and 3 tropical storms). On 24 June 2010, the City University of Hong Kong group issued a forecast for a similar reduction to the number of cyclones for 2010.

Using his newly developed statistical forecast scheme, Paul Stanko at WFO Guam rated the odds of cyclone numbers for the typhoon season of 2010 as follows: Category forecasts: Record High (44 or more): **0%**, Far Above Normal (38 to 44): **1%**, Above Normal (33 to 37): **9%**, Near Normal (29 to 32): **29%**, Below Normal (27 or 28): **15%**, Far Below Normal (21 to 26): **40%**, Record Low (21 or less): **10%**.

<sup>1</sup>The PEAC tropical cyclone forecasts for 2010 are provisional. The PEAC considers input from three seasonal outlooks for tropical cyclone activity in the western North Pacific basin: (1) The City University of Hong Kong Laboratory for Atmospheric Research, under the direction of Dr. J. C-L. Chan; (2) The Benfield Hazard Research Centre, University College London, Tropical Storm Risk (TSR) research group, UK, led by Dr Adam Lea and Professor Mark Saunders (<http://www.tropicalstormrisk.com>); and, (3) an experimental typhoon outlook produced by Paul Stanko (forecaster at the Guam WFO).

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## LOCAL SUMMARY AND FORECAST



**American Samoa:** American Samoa has entered its dry season. After a very wet rainy season, the opening months of the current dry season saw below-normal rainfall values. Normal rainfall at Pago Pago exceeds 10 inches per month from October through April, and is less than 10 inches per month from May through September. Its driest month is typically July, with just over 6 inches. Gusty trade winds were reported over the past two months, and these will continue through September.

American Samoa Rainfall Summary 2nd Qtr and First Half of 2010						
Station		Apr.	May	Jun.	2nd Qtr	1st Half
Pago Pago WSO	Inches	10.33	6.61	5.05	21.99	71.11
	% Norm	86%	67%	68%	75%	108%
Aasufou	Inches	12.01	16.79	26.75	55.55	N/A
	% Norm	66%	109%	237%	124%	N/A

**Climate Outlook:** American Samoa is now entering the heart of its dry season. Although the first two months of the dry season (May and June) were drier than normal, climate models favor near-normal to above-normal rainfall over the next three-month period. The next rainy season (Oct 2010 - Apr 2011) is currently anticipated to have near-normal rainfall with a normal or slightly reduced risk of a tropical cyclone. Anticipated La Niña conditions persisting into the fall of 2010 should favor tropical cyclone activity in the Coral Sea from northeast Australia across to Fiji.

Predicted rainfall for American Samoa from July 2010 through June 2011 is:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>
July - September 2010 (Heart of Dry Season)	110% (30.28 inches - Pago Pago)
October - December 2010 (Onset of next Rainy Season)	100%
January - March 2011 (Heart of next Rainy Season)	100%
April - June 2011 (Onset of next Dry Season)	100%

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.



**Guam/CNMI:** Throughout Guam and the CNMI, the rainfall during the first half of 2010 was below normal, with most locations throughout these islands experiencing 60% to 80% of average rainfall. The island of Rota in the CNMI was the only recording location in the region to experience above-normal rainfall during the first half of 2010, largely a result of a wet January. Guam and the CNMI are typically drier than normal during the first half of a year that follows El Niño. February and May were particularly dry with monthly rainfall at or below one inch. Grassland fires were common. Low rates of stream flow at popular waterfall sites on Guam caused their base pools to become stagnant and fill with strands of algae. Isolated thunderstorm activity in late June provided northern Guam with

## LOCAL SUMMARY AND FORECAST

some much needed rainfall. Elsewhere, it remained quite dry through the second quarter months, with some locations receiving an increase in their June rainfall from isolated thunderstorm activity.

During the 24-hour period of 10 AM 23 June to 10 AM 24 June, northern Guam experienced a heavy rain event, with some locations (including Anderson Air Force Base) receiving approximately 6 inches. This heavy rain (accompanied by frequent lightning) was the product of a sequence of thunderstorms that repeatedly formed over the northern one-third of Guam in response to convective instability triggered by a vigorous Tropical Upper Tropospheric Trough (TUTT) cell. On satellite imagery this TUTT cell had the appearance of a tropical cyclone, but in reality, it was a large cyclonic vortex located in the upper atmosphere with light winds at the surface. The cores of TUTT cells are often peppered with many individual thunderstorms, and conditions inside them are especially favorable for spectacular displays of lightning.

Guam and CNMI Rainfall Summary 2nd Qtr and First Half of 2010						
Station		Apr.	May	Jun.	2nd Qtr	1st Half
Guam						
GIA (WFO)	Inches	2.16	0.74	5.33	8.23	18.38
	% Norm	55%	12%	82%	50%	67%
AAFB	Inches	4.83	1.15	8.96	14.94	27.08
	% Norm	99%	17%	141%	84%	83%
Dededo (Ypapao)	Inches	4.08	0.97	7.55	12.60	25.25
	% Norm	87%	15%	119%	71%	77%
Ugum Watershed	Inches	4.68	1.42	5.44	11.54	20.80
	% Norm	96%	23%	84%	65%	63%
Sinajaña	Inches	1.29	1.18	6.04	8.51	17.18
	% Norm	33%	20%	93%	52%	62%
CNMI						
Saipan Intl. Airport	Inches	2.35	0.60	2.66	5.61	11.65
	% Norm	84%	14%	57%	47%	60%
Capitol Hill	Inches	2.29	1.01	4.94	8.24	14.56
	% Norm	65%	18%	85%	56%	60%
Tinian Airport	Inches	2.91	1.32	2.28	6.61	14.30
	% Norm	83%	24%	39%	45%	59%
Rota Airport	Inches	2.63	2.11	6.21	10.95	34.76
	% Norm	58%	33%	100%	64%	113%

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**Climate Outlook:** The rainy season has commenced on Guam and in the CNMI. The average rainfall on Guam is at or above 10 inches per month from July through October. Interestingly, the average rainfall at Saipan is roughly 2 inches less than the monthly rainfall on Guam for all months of the year. During the years that follow El Niño, the dry season on Guam and in the CNMI is drier than normal, and is often prolonged into July. The rainy season of years that follow El Niño is also typically shorter and drier than normal in Guam and in the CNMI. These two island groups are among the few places in Micronesia where rainfall does not fully recover to normal or above normal annual amounts following El Niño. Guam and the CNMI depend on tropical cyclone and monsoon trough activity for much of their rainy-season rainfall, and following an El Niño event, the weather becomes tranquil (inhibited monsoon with a reduction of tropical cyclones). The odds are cut in half (to 10%, but not zero) for the occurrence of a tropical cyclone. The chances for extremes of rainfall (4 or more inches of rain in 24 hours) are similarly reduced. Rainy-season totals during the years that follow El Niño around 85 to 95 percent of normal, with stronger El Niño events tending to have the greater influence (consider the extreme dry conditions of the years that followed both the 1982 and 1997 El Niño events).

Predicted rainfall for the Mariana Islands from July 2010 through June 2011 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>	
	Guam/Rota	Saipan/Tinian
July - September 2010 (Heart of Rainy Season)	<b>90%</b> <b>(34.00 inches)</b>	<b>85%</b> <b>(24.53 inches)</b>
October - December 2010 (End of Rainy Season)	<b>90%</b>	<b>90%</b>
January - March 2011 (Onset of Next Dry Season)	<b>100%</b>	<b>100%</b>
April - June 2011 (2nd Half of Next Dry Season)	<b>100%</b>	<b>100%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**Federated States of Micronesia**

**Yap State:** All Yap Island locations were relatively dry during the first half of 2010, with the months of February and May being particularly dry (less than 3 inches in each month). 2010 First Half rainfall totals were about two-thirds of normal, while 2nd Quarter totals edged closer to normal (75%). The weather at Yap Island and the atolls of Yap State was mostly unremarkable during the first half of 2010. Water supplies remained adequate despite the relatively dry conditions. On the morning of 23 March, Tropical Storm Omais (the only named tropical cyclone in the western North Pacific basin in the first half of 2010) passed close to the island of Ulithi. No significant damage or injuries were reported.

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Yap Rainfall Summary 2nd Qtr and First Half of 2010						
Station		Apr.	May	June	2nd Qtr	1st Half
Yap Island						
Yap WSO	Inches	7.11	2.96	9.89	<b>19.96</b>	<b>31.69</b>
	% Norm	123%	32%	78%	<b>73%</b>	<b>68%</b>
Dugor	Inches	7.79	2.49	9.78	<b>20.06</b>	<b>31.52</b>
	% WSO	135%	27%	77%	<b>73%</b>	<b>67%</b>
Gilman	Inches	6.82	2.46	7.33	<b>16.61</b>	<b>28.98</b>
	% WSO	118%	27%	58%	<b>60%</b>	<b>62%</b>
Luweech	Inches	7.07	2.03	10.40	<b>19.50</b>	<b>31.28</b>
	% WSO	122%	22%	82%	<b>71%</b>	<b>67%</b>
Maap	Inches	8.54	1.13	5.65	<b>15.32</b>	<b>28.93</b>
	% WSO	148%	12%	45%	<b>56%</b>	<b>62%</b>
North Fanif	Inches	7.08	3.19	9.94	<b>20.21</b>	<b>31.32</b>
	% WSO	122%	34%	78%	<b>73%</b>	<b>67%</b>
Rumung	Inches	8.16	2.68	10.03	<b>20.87</b>	<b>37.39</b>
	% WSO	141%	29%	79%	<b>76%</b>	<b>80%</b>
Tamil	Inches	7.47	2.69	10.66	<b>20.82</b>	<b>32.04</b>
	% WSO	129%	29%	84%	<b>76%</b>	<b>68%</b>
Outer Islands						
Ulithi	Inches	2.89	2.16	9.70	<b>14.75</b>	<b>25.64</b>
	% Norm	59%	28%	90%	<b>63%</b>	<b>64%</b>
Woleai	Inches	9.26	6.96	5.00*	<b>17.26*</b>	<b>28.15*</b>
	% Norm	84%	57%	38%*	<b>37%*</b>	<b>45%*</b>

\* Estimated (19-20 June data missing)

**Climate Outlook:** Since Yap State is located in the western side of Micronesia, a westward shift of basin tropical cyclone activity and also of the western North Pacific monsoon will not substantially affect the rainfall or the typical distribution of tropical cyclones in the region. Near normal rainfall is anticipated for all islands of Yap State for at least the remainder of 2010 and probably through the next dry season. Similarly, the odds of gale-force winds or greater from a tropical cyclone on Yap Island or any of its northern atolls will be near normal.

Predicted rainfall for Yap State from July 2010 through June 2011 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>	
	Yap and Ulithi	Woleai
July - September 2010 (Heart of Rainy Season)	<b>95%</b> <b>(25.83 inches)</b>	<b>95%</b> <b>(34.44 inches)</b>
October - December 2010 (End of Rainy Season)	<b>100%</b>	<b>110%</b>
January - March 2011 (Heart of Next Dry Season)	<b>95%</b>	<b>100%</b>
April - June 2011 (Onset of next Rainy Season)	<b>100%</b>	<b>110%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

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**Chuuk State:** Rainfall in Chuuk State during the first half of 2010 had a large north-south gradient reflecting the placement of the trade-wind trough across the southern portions of the state. The northern atolls received the least amount of rain, and some of the atolls further south in the Mortlocks received the most. The 67.54 inches observed at Ettal Atoll in the southern Mortlocks was the highest observed 2010 First Half total throughout Chuuk State. The 34.97 inches and 25.22 inches observed at Fananu and Piis Panew, respectively, were among the lowest readings during the first half of 2010. The 49.61 inches recorded at the Chuuk WSO during the first half of 2010 was well below normal (81%).

Chuuk State Rainfall Summary 2nd Qtr and First Half of 2010						
Station		Apr.	May	June	2nd Qtr	1st Half
<b>Chuuk Lagoon</b>						
<b>Chuuk WSO</b>	<b>Inches</b>	12.46	9.80	5.63	<b>27.89</b>	<b>49.61</b>
	<b>% Norm</b>	101%	80%	48%	<b>77%</b>	<b>81%</b>
<b>Piis Panew</b>	<b>Inches</b>	5.87	8.23	8.23	<b>17.19</b>	<b>25.22</b>
	<b>% WSO</b>	N/A	N/A	N/A	<b>47%</b>	<b>41%</b>
<b>Southern Mortlocks</b>						
<b>Lukunoch</b>	<b>Inches</b>	20.04	10.94	4.52	<b>35.50</b>	<b>66.10</b>
	<b>% WSO</b>	N/A	N/A	N/A	<b>98%</b>	<b>107%</b>
<b>Ettal</b>	<b>Inches</b>	18.81	16.44	7.42	<b>42.67</b>	<b>67.54</b>
	<b>% WSO</b>	N/A	N/A	N/A	<b>118%</b>	<b>110%</b>
<b>Ta</b>	<b>Inches</b>	13.87	13.51	4.03	<b>31.41</b>	<b>65.51</b>
	<b>% WSO</b>	N/A	N/A	N/A	<b>87%</b>	<b>107%</b>
<b>Namoluk</b>	<b>Inches</b>	16.39	11.70	12.86	<b>40.95</b>	<b>61.89</b>
	<b>% WSO</b>	N/A	N/A	N/A	<b>113%</b>	<b>101%</b>
<b>Northern Atolls</b>						
<b>Fananu</b>	<b>Inches</b>	10.45	3.73	8.34	<b>22.52</b>	<b>34.97</b>
	<b>% WSO</b>	N/A	N/A	N/A	<b>62%</b>	<b>57%</b>
<b>Onoun</b>	<b>Inches</b>	5.24	3.37	13.35	<b>21.96</b>	<b>42.14</b>
	<b>% WSO</b>	N/A	N/A	N/A	<b>60%</b>	<b>69%</b>
<b>Northern Mortlocks</b>						
<b>Losap</b>	<b>Inches</b>	6.76	8.74	12.31	<b>27.81</b>	<b>49.09</b>
	<b>% WSO</b>	N/A	N/A	N/A	<b>77%</b>	<b>80%</b>
<b>Nama</b>	<b>Inches</b>	10.18	8.34	11.02	<b>29.54</b>	<b>58.16</b>
	<b>% WSO</b>	N/A	N/A	N/A	<b>81%</b>	<b>96%</b>
<b>Western Atolls</b>						
<b>Polowat</b>	<b>Inches</b>	8.24	6.32	3.34	<b>17.90</b>	<b>28.79</b>
	<b>% Norm</b>	137%	70%	27%	<b>60%</b>	<b>65%</b>

## LOCAL SUMMARY AND FORECAST

**Climate Outlook:** Easterly low-level winds should continue to dominate the flow throughout Chuuk State for the next three months, with a below average number of days with west or southwest winds. The weather patterns during the remainder of 2010 are anticipated to be analogous to the atmospheric weather patterns seen during 2008 when easterly winds and tranquil weather persisted for the whole year. Rainfall should be near normal. Beginning in August and continuing through December, a few of the tropical cyclones of the western North Pacific basin will begin their lives in Chuuk State as depressions. One or two occurrences of gale-force winds associated with a developing tropical cyclone may affect Chuuk Lagoon or atolls to the north, especially in the fall of 2010. This represents a near normal risk of hazardous effects from tropical cyclones.

Because of the easterly wind anomalies expected to dominate the low-level wind pattern across Micronesia and the equatorial Pacific, the sea level should continue to rise, and sea-level anomalies should approach or exceed those seen in the region during 2008. Higher-than-normal sea level will expose the atolls of Chuuk State to a heightened risk of sea inundation, especially towards the end of the year (late November and December 2010). At this time of the year, the extra-tropical low pressure systems that move eastward from Japan may produce large northerly swells that will move south from their North Pacific origin and pass through Chuuk State causing coastal sea inundations from large waves on some atolls where similar conditions caused sea inundation in December 2008.

Predictions for Chuuk State from July 2010 through June 2011 are as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>			
	Chuuk Lagoon, Losap, and Nama	Polowat	Northern Islands	Southern Mortlocks
Jul – Sep 2010	<b>90%</b> (31.98 inches)	<b>80%</b> (28.44 in)	<b>90%</b> (31.99 in)	<b>95%</b> (33.77 in)
Oct – Dec 2010	<b>100%</b>	<b>95%</b>	<b>100%</b>	<b>100%</b>
Jan – Mar 2011	<b>95%</b>	<b>90%</b>	<b>90%</b>	<b>100%</b>
Apr - Jun 2011	<b>110%</b>	<b>95%</b>	<b>95%</b>	<b>110%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**Pohnpei State:** Weather conditions on Pohnpei Island and the atolls of Pohnpei State during the first half of 2010 were generally unremarkable. A very dry February gave way to an immediate return of abundant rainfall in March. Water supplies and stream flow were reported to be adequate. As usual, Palikir topped the list of rainfall totals in Pohnpei State during the first half of 2010 with 111.50 inches (114%). This was the highest total rainfall observed throughout Micronesia during the first half of 2010. A few miles away at the WSO Pohnpei, the rainfall total for the first half of 2010 was 83.58 (93%). Rainfall totals at the atolls of Pohnpei State for the first half of 2010



## LOCAL SUMMARY AND FORECAST

ranged from below normal (75%) at Pingelap, Mwoakilloa, and Nukuoro, to above normal (117%) at Kapingamarangi.

Pohnpei State Rainfall Summary 2nd Qtr and First Half of 2010						
Station		Apr.	May	June	2nd Qtr	1st Half
<b>Pohnpei Island</b>						
<b>Pohnpei WSO</b>	<b>Inches</b>	22.76	13.72	13.17	<b>49.65</b>	<b>83.58</b>
	<b>% Norm</b>	138%	72%	77%	<b>94%</b>	<b>93%</b>
<b>Palikir</b>	<b>Inches</b>	27.11	25.59	14.66	<b>67.36</b>	<b>111.50</b>
	<b>% Norm</b>	153%	124%	79%	<b>118%</b>	<b>114%</b>
<b>Kolonia Airport</b>	<b>Inches</b>	17.37	11.40	N/A	N/A	N/A
	<b>% Norm</b>	99%	73%	N/A	N/A	N/A
<b>Atolls of Pohnpei State</b>						
<b>Nukuoro</b>	<b>Inches</b>	17.38	16.11	9.89	<b>43.38</b>	<b>75.14</b>
	<b>% Norm</b>	116%	109%	81%	<b>103%</b>	<b>77%</b>
<b>Pingelap</b>	<b>Inches</b>	9.66	6.26	12.46	<b>28.38</b>	<b>66.98</b>
	<b>% Norm</b>	56%	37%	77%	<b>56%</b>	<b>75%</b>
<b>Mwoakilloa</b>	<b>Inches</b>	9.00	8.93	12.46	<b>30.39</b>	<b>58.34</b>
	<b>% Norm</b>	67%	57%	89%	<b>70%</b>	<b>79%</b>
<b>Kapingamarangi</b>	<b>Inches</b>	17.99	12.20	6.60	<b>36.79</b>	<b>77.01</b>
	<b>% Norm</b>	132%	118%	91%	<b>118%</b>	<b>117%</b>

**Climate Outlook:** Easterly low-level winds should continue to dominate throughout Pohnpei State for the next three months, with a well below-average number of days with west or south-west winds (i.e., the monsoon trough will rarely extend to Pohnpei's longitude). The weather patterns during the remainder of 2010 are anticipated to be analogous to the atmospheric weather patterns seen during 2008 when easterly winds and unremarkable weather (for Pohnpei) persisted for the whole year. Rainfall for the next foreseeable months of 2010 should be near normal. This risk on Pohnpei Island or any of the atolls of Pohnpei State of hazardous effects from tropical cyclones is anticipated to be very low for the remainder of the year.

Because of the easterly wind anomalies expected to dominate the low-level wind pattern across Micronesia and the equatorial Pacific, the sea level should continue to rise at most locations of Pohnpei State, particularly north of 4 degrees N, and sea level anomalies should approach or exceed those seen in the region during 2008. Higher-than-normal sea level will expose the reef margins of Pohnpei Island and the atolls of Pohnpei State to a heightened risk of hazardous surf, especially towards the end of the year (late November and December 2010). At this time of the year, the extra-tropical low pressure systems that move eastward from Japan may produce large northerly swells that will move south from their North Pacific origin and pass through Pohnpei State causing large waves to impact reefs and atolls as they did during December 2008. Gusty easterly winds coupled with higher than normal sea level often result in sea water splashing onto the airport causeway at high tide. This may occur more frequently than normal late in 2010 through early 2011 as the trade winds strengthen after their summer lull.

## LOCAL SUMMARY AND FORECAST

No typhoons or tropical storms are anticipated to adversely affect Pohnpei State during 2010, although several of the basin's tropical cyclones may begin as disturbances near Pohnpei. These will contribute to the expected normal rainfall.

Predicted rainfall for Pohnpei State from July 2010 through June 2011 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>	
	<b>Pohnpei Island and atolls</b>	<b>Kapingamarangi</b>
Jul - Sep 2010	<b>95%</b> <b>(53.56 inches)</b>	<b>100%</b> <b>(31.28 inches)</b>
Oct - Dec 2010	<b>100%</b>	<b>100%</b>
Jan - Mar 2011	<b>100%</b>	<b>100%</b>
Apr - Jun 2011	<b>100%</b>	<b>95%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**Kosrae State:** Kosrae is typically one of Micronesia's wettest locations. Sometimes it is overtaken by Palikir on Pohnpei Island as the highest observed rainfall total in Micronesia. During the first half of 2010, it was relatively dry on Kosrae, with February being particularly dry. The airport's first half of 2010 total of 82.41 inches was 76% of normal, and was exceeded by Palikir's chart-topping rainfall of 111.50 inches for the same time period. Other Kosrae recording sites (Tofol, Utwa and the Nautilus Hotel) were also relatively dry during the first half of 2010. Normal monthly rainfall values at Kosrae are typically between 17 and 20 inches for all months of the year, with the months of March through June on the high end of this range, and the other months closer to the lower end of this range. During the first half of 2010, only one month (April) had rainfall in excess of 20 inches.

Kosrae State Rainfall Summary 2nd Qtr and First Half of 2010						
Station		Apr.	May	June	2nd Qtr	1st Half
<b>Airport (SAWRS)</b>	<b>Inches</b>	23.82	11.92	13.80	<b>49.54</b>	<b>82.41</b>
	<b>% Norm</b>	110%	63%	73%	<b>83%</b>	<b>76%</b>
<b>Utwa</b>	<b>Inches</b>	27.59	14.11	15.09	<b>56.79</b>	<b>93.79</b>
	<b>% WSO</b>	127%	75%	79%	<b>96%</b>	<b>86%</b>
<b>Tofol</b>	<b>Inches</b>	21.12	15.02	14.81	<b>50.95</b>	<b>78.30</b>
	<b>% WSO</b>	98%	80%	78%	<b>86%</b>	<b>72%</b>
<b>Nautilus Hotel</b>	<b>Inches</b>	26.35	11.30	13.19	<b>50.84</b>	<b>85.58</b>
	<b>% WSO</b>	122%	60%	69%	<b>86%</b>	<b>79%</b>

**Climate Outlook:** For the next several months, persistent trade winds should dominate in Kosrae and throughout eastern Micronesia. This is typically associated with near-normal rainfall. Although the first half of 2010 was drier than normal, it is anticipated that the rainfall for the next several months will be near normal. No adverse tropical cyclone activity is expected for Kosrae State during the remaining months of 2010.

## LOCAL SUMMARY AND FORECAST

Predicted rainfall for Kosrae State from July 2010 through June 2011 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>
July - September 2010	<b>95%</b> <b>(56.49 inches)</b>
October - December 2010	<b>100%</b>
January - March 2011	<b>100%</b>
April - June 2011	<b>120%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.



**Republic of Palau:** All recording locations throughout the Republic of Palau were relatively dry during the first half of 2010, with the months of February and March being particularly dry (less than 4 inches in each of these months at the WSO Koror). 2010 First Half rainfall totals were about two-thirds of normal, while 2nd Quarter totals edged closer to normal at most locations. Nekken Forestry reported the most rain (63.28 inches), and the WSO Koror had the least amount of rain (40.58 inches). During El Niño, the Republic of Palau is often one of the first locations in Micronesia to experience below-normal rainfall. This did not happen, and Palau remained wet through the end of 2009. Then in the 1st Quarter of 2010, dry conditions became established, and continued through June.

Republic of Palau Rainfall Summary 2nd Qtr and First Half of 2010						
Station		Apr.	May	June	2nd Qtr	1st Half
WSO Koror	Inches	6.62	9.68	10.35	26.65	40.58
	% Norm	76%	81%	60%	70%	62%
Nekken	Inches	9.13	12.32	14.04	35.49	63.28
	% Norm	105%	103%	81%	94%	96%
Intl. Airport	Inches	9.36	8.41	12.60	30.37	49.24
	% Norm	108%	70%	73%	80%	75%
Peleliu	Inches	7.30	10.35	9.24	26.89	41.43
	% Norm	84%	86%	54%	71%	63%

**Climate Outlook:** The distribution of rainfall on Palau during the next few months will still be affected by the waning El Niño. It has already been quite dry throughout Palau in the first three months of the year. During May, rainfall normally increases in Palau, and the months of June and July are typically the wettest of the year. The steep increase of rainfall normally experienced in May and June was delayed. Rainfall should rebound to normal during July and continue to be near normal thereafter. Tropical cyclone influence on Palau should be near normal for the remainder of 2010. Two or three episodes of gusty winds and heavy showers associated with tropical cyclones passing to the north are likely, with the greatest risk of these events during September through December.

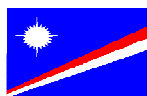
## 3rd Quarter, 2010

## LOCAL SUMMARY AND FORECAST

Predicted rainfall for Palau from July 2010 through June 2011 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>
July – September 2010	<b>110%</b> <b>(42.07 inches)</b>
October – December 2010	<b>120%</b>
January – March 2011	<b>110%</b>
April - June 2011	<b>120%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.

**Republic of the Marshall Islands (RMI):**

While the first half of 2010 was generally dry, the month of June 2010 was extremely wet at some locations, notably at Majuro, Mili and Arno. The 20.86 inches of rain recorded at the WSO Majuro for June 2010 was the first month at or above 20 inches since October 2007, and it represents the wettest June monthly total in the climatic record. The previous June record monthly rainfall for the WSO Majuro was the 17.63 inches recorded in June 1975. In spite of this extraordinary June 2010 total, the rainfall was still below normal for the 2nd Quarter and 1st Half of 2010 at all RMI locations.

Other atolls in the vicinity of Majuro (e.g., Mili and Arno) also had large June totals, but none quite as large as the 20-plus inches at Majuro. Many atolls in the northern RMI had a very dry May, which negated June's enhanced totals in the quarterly and half-year summaries. The RMI has been dry for a long time. The long-term climate records at Kwajalein and at Majuro

RMI Rainfall Summary 2nd Qtr and First Half of 2010						
Station		Apr.	May	June	2nd Qtr	1st Half
RMI Central Atolls (6° N - 8° N)						
Majuro WSO	Inches	9.41	2.42	20.86	32.69	51.05
	% Norm	92%	22%	180%	99%	91%
Arno	Inches	N/A	2.42*	18.42	N/A	N/A
	% Norm	N/A	N/A	N/A	N/A	N/A
Mili	Inches	7.59	7.15	16.02	30.76	49.15
	% Norm	74%	64%	138%	93%	88%
Alin-glappap	Inches	2.21	2.69	N/A	N/A	N/A
	% Norm	N/A	N/A	N/A	N/A	N/A
Jaluit	Inches	6.93	7.93	9.12	23.98	45.54
	% Norm	67%	71%	79%	73%	81%
RMI Central Atolls (6° N - 8° N)						
Kwajalein	Inches	1.72	2.88	11.01	15.61	25.99
	% Norm	23%	29%	114%	57%	67%
Wotje	Inches	0.12	1.29	2.78	4.19	7.04
	% Norm	2%	14%	30%	16%	19%

\* Estimated from Majuro total.



## LOCAL SUMMARY AND FORECAST

(which begin in the early 1950s) show a long slow decline of mean annual rainfall that is statistically significant. At the WSO Majuro, the downward trend of annual rainfall is such that there is now a loss of nearly 20 inches of annual rainfall during the 2000s versus the 1950s. At Kwajalein, the loss of annual rainfall over the same time period is approximately 14 inches.

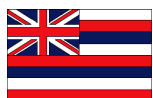
**Climate Outlook:** A weather pattern similar to that seen during 2008 has developed in the western North Pacific. This pattern features widespread easterly low-level winds, tropical cyclones pushed to the west of normal, a delayed tropical cyclone season, and a weak (or absent) monsoon trough. In this pattern, the trade-wind trough dominates the weather of the RMI. Low pressure systems in the upper atmosphere (TUTT cells) passing north of the RMI modulate the deep convection, and help to bring bouts of heavy rain showers to the atolls. During 2008, this type of anomalous weather pattern brought below normal rainfall to most of the RMI throughout the year. However, recent TUTT cell activity and trade-wind trough cloud clusters producing episodes of heavy rain showers bode well for near-normal rainfall throughout the RMI for the rest of 2010.

Because of the easterly winds expected to dominate the low-level wind pattern across Micronesia and the equatorial Pacific, the sea level should continue to rise throughout Micronesia. Sea-level anomalies should approach or exceed those seen in the region during 2008. Higher-than-normal sea level will expose the atolls of the RMI to a heightened risk of coastal inundation, especially towards the end of the year (late November and December 2010). At this time of the year, the extra-tropical, low pressure systems that move eastward from Japan may produce large northerly swells that will move out of North Pacific waters and pass through the RMI causing coastal inundations on some atolls where similar conditions (large waves coupled with higher-than-normal sea level) caused sea inundation in December 2008. The large waves of 2008 were a 30 to 40-year event (or longer), so waves of this magnitude are not forecasted at this time, but any large wave event coupled with higher-than-normal sea level poses an enhanced risk of coastal inundation.

Predicted rainfall for the RMI from July 2010 through June 2011 is as follows:

Inclusive Period	% of long-term average / Forecast rainfall (inches) <sup>1</sup>		
	South of 6°N	6°N to 8°N	North of 8°N
July – Sept 2010	<b>100%</b> (33.92 inches)	<b>110%</b> (37.31 in)	<b>100%</b> (25.11 in)
Oct – Dec 2010	<b>100%</b>	<b>110%</b>	<b>110%</b>
Jan – Mar 2011	<b>100%</b>	<b>95%</b>	<b>90%</b>
Apr - June 2011	<b>100%</b>	<b>95%</b>	<b>95%</b>

<sup>1</sup> Forecast rainfall quantities represent BEST ESTIMATES given the probabilistic forecast for each particular season and station.



**Hawai'i:** The 2009-2010 Hawaiian Islands wet season ranks as the driest in the past thirty years. The recently completed October 2009 - April 2010

## LOCAL SUMMARY AND FORECAST

Hawaiian Island wet season, or “Hooilo”, ranks as the driest in the past thirty years and on of the driest in the past 55 years. This is based on an average of wet season rainfall rankings from seven reporting stations across the state with continuous records. These stations are Lihue Airport, Honolulu Airport, Manoa Lyon Arboretum, Molokai Airport, Ulupalakua Ranch, Kapapala Ranch, and Hilo airport. Note that overall ranking can vary depending on the stations used in the calculation.

As highlighted in an October 20, 2009 NOAA media release, the development of an El Niño during the summer of 2009 resulted in a forecast of drier than normal conditions in the Hawaiian Islands following the hurricane season. Existing agricultural drought in the eastern half of the state worsened, especially in the Kona, Kua, and Leeward Kohala sections of the Big Island. Impacts to Agricultural Operations span a wide range of sectors including livestock, coffee, and ornamental flowers. Residents depending on rainfall catchment also suffered from the dry conditions and required costly water delivery to meet basic needs. Please refer to the latest drought information statement at: <http://www.weather.gov/data/hfo/dgthfo>.

For comparison purposes the following are the 5 wettest and 5 driest October - April wet seasons over the last thirty years:

5 Wettest: 1. 1981-1982, 2. 1988-1989, 3. 1996-1997, 4. 1990-1991, 5. 2003-2004. 5 Driest: 1. 2009-2010, 2. 1997-1998, 3. 1991-1992, 4. 1980-1981, 5. 1999-2000.

State of Hawaii Rainfall Summary 2ndQtr and First Half of 2010						
Station		Apr.	May	Jun.	2nd Qtr	1st Half
Lihue Airport	Inches	1.32	2.21	1.11	<b>4.64</b>	<b>8.40</b>
	% Norm	44%	77%	85%	<b>60%</b>	<b>44%</b>
Honolulu Airport	Inches	0.28	1.42	0.22	<b>1.92</b>	<b>3.89</b>
	% Norm	25%	182%	55%	<b>83%</b>	<b>42%</b>
Kahului Airport	Inches	0.77	0.05	0.08	<b>0.90</b>	<b>3.91</b>
	% Norm	44%	8%	35%	<b>34%</b>	<b>35%</b>
Hilo Airport	Inches	7.00	2.71	5.26	<b>14.97</b>	<b>17.98</b>
	% Norm	56%	34%	71%	<b>54%</b>	<b>29%</b>

**Climate Outlook:** The following comments are from the U.S. Climate Prediction Center's Seasonal Outlook Discussion:

“Moderate to exceptional drought (D1 to D4 designations) continues across the leeward sides of the Hawaiian Islands. Forecasts for these areas call for below median rainfall during August - October, leading to drought persistence. A relatively dry climatology also supports persistence. Beyond this time period, expected wetness associated with La Niña conditions may bring improvement during the 2010-11 winter season.”

**For more information on  
weather and climate in Hawai'i go to:**  
<http://www.prh.noaa.gov/pr/hnl/>

or  
[www.cpc.noaa.gov/products/predictions/long\\_range/fxhw40.html](http://www.cpc.noaa.gov/products/predictions/long_range/fxhw40.html)

## Seasonal Sea-Level Outlook for the US-Affiliated Pacific Islands

The following sections describe: (i) the *Canonical Correlation Analysis (CCA)* forecasts for seasonal (mean and maxima) sea-level deviations for the forthcoming seasons JAS, ASO, and SON of 2010; (ii) the observed monthly mean and maximum sea-level deviations for the season AMJ 2010; (iii) forecast verifications for AMJ 2010 (observed/forecast values). *Note that the CCA-forecasting technique adapted here accounts for ENSO-related sea-level deviations and does not account for sea-level deviations created by other atmospheric or geological factors such as tropical cyclones, storm surges or tsunamis*

(i) **Seasonal Sea-Level Forecast** (*deviations with respect to climatology*) for JAS, ASO, and SON 2010 (Table 1). See Figure 2 for locations of tide stations.

**Table 1: Forecasts of sea-level deviation (in inches) for July-Aug-Sep, Aug-Sep-Oct, and Sep-Oct-Nov 2010.**

Tide Gauge Station	Seasonal Mean Deviations <sup>1</sup>				Seasonal Max Deviations <sup>2</sup>					
	JAS	ASO	SON	Forecast Quality <sup>3</sup>	JAS	ASO	SON	Forecast Quality <sup>3</sup>	Return Period <sup>4</sup> for JAS Season	
Lead Time <sup>5</sup>	0	1M	2M		0	1M	2M		20 Year	100 Year
Marianas, Guam	+5	+3	+2	Good	+20	+20	+18	V. Good	6.3	10.9
Malakal, Palau	+5	+5	+4	V. Good	+40	+42	+40	Good	8.1	10.2
Yap, FSM	+5	+4	+3	V. Good	+31	+32	+30	Good	8.4	11.3
Chuuk, FSM**	+3	+3	+3	N/A	+31	+31	+33	N/A	N/A	N/A
Pohnpei, FSM	+3	+3	+3	Good	+31	+31	+33	Good	5.8	7.0
Kapingamarangi, FSM	+2	+2	+3	Good	+27	+27	+28	Fair	3.5	4.2
Majuro, RMI	+2	+2	+3	Good	+41	+43	+44	Fair	5.2	6.8
Kwajalein, RMI	+2	+2	+2	Good	+40	+40	+40	Fair	4.1	5.2
Pago Pago, AS	+3	+3	+3	V. Good	+28	+27	+27	V. Good	4.1	5.4
Honolulu, Hawai'i	+2	+2	+3	Fair	+21	+20	+21	Fair	3.4	5.7
Hilo, Hawai'i	+2	+3	+3	Good	+24	+24	+24	Good	6.4	7.4

**Remarks:** The forecast values of sea level for the JAS, ASO, and SON seasons (Table 1, above) indicate that sea levels for most of the stations in the north Pacific are likely to rise in the forthcoming seasons. The maximums will also be higher than normal during the same time period (Table 1, right panel). This will be due to prevailing stronger-than-average westerly wind anomalies in the vicinity of western and central tropical Pacific. The Hawaiian stations are also likely to be slightly elevated during the same time period.

The forecast values of sea level for the coming seasons are supportive of a borderline La Niña condition, which recently appeared in mid-June.

**Note:** (-) indicates negative deviations (fall of sea level from the mean), and (+) indicates positive deviations (rise of sea level from the mean); N/A: data not available. Deviations from -1 to +1 inch are considered negligible, and deviations from -2 to +2 inches are unlikely to cause any adverse climatic impact. Forecasts for Chuuk (\*\*) are estimated subjectively based on information from WSO Chuuk and observations from neighboring stations in Pohnpei and Yap.

**Seasonal Mean Deviation (1)** is defined as the difference between the mean sea level for the given month and the 1975-1995 mean sea-level value at each station. Likewise, **Seasonal Maximum Deviation (2)** is defined as the difference between the maximum sea level (calculated from hourly data) for the given month and the 1975-1995 mean sea-level value at each station.

**Forecast Quality (3)** is a measure of the expected CCA cross-validation correlation skill. Higher skills correspond to greater expected accuracy of the forecasts. In general terms, these kinds of forecasts are thought to be of useful (but poor) skill if the CCA cross-validation value lies between 0.3 and 0.4. Skill levels greater than 0.4/0.6 are thought to be fair/good skills. Skill levels greater than 0.7 are thought to be very good. Refer to [www.prh.noaa.gov/peac/peu/2010\\_3rd/sea\\_level.php](http://www.prh.noaa.gov/peac/peu/2010_3rd/sea_level.php) for cross-validation skills.

**Return period (RP) (4)** of extreme values are calculated from hourly sea-level data. For example, the predicted rise of 6.3 inches at 20-year RP at Marianas, Guam indicates that this station may experience an extreme tide event once every 20 years that could result in sea-level rise of up to 6.3 inches above the median of seasonal maxima during the JAS season. Likewise, about once every 100 years we can expect the highest JAS tide at Marianas, Guam to be as high as 10.9 inches above the median of seasonal maxima. During some seasons some stations display alarmingly high values at the 20 and 100 year RP. *These high values are due to large and significant increases in the tidal range caused by the passage of past storm events during that season.*

**Lead time (5)** is the time interval between the end of the initial period and the beginning of the forecast period. For example, lead-0, lead-1M, and lead-2M means 'sea level' of target season 0 (JAS), 1 (ASO), and 2 (SON) month leads based on SSTs of AMJ 2010.

## Seasonal Sea-Level Outlook for the US-Affiliated Pacific Islands

## (ii) Observed Monthly Sea-Level Deviation in the April-May-June (AMJ) 2010 Season

The monthly time series (April - June 2010) for sea-level deviations have been taken from the UH Sea Level Center. The full time series (in mm) is available at <ftp://ilikai.soest.hawaii.edu/islp/slpp/deviations>. See **Figure 2** (below) for the locations of these stations.

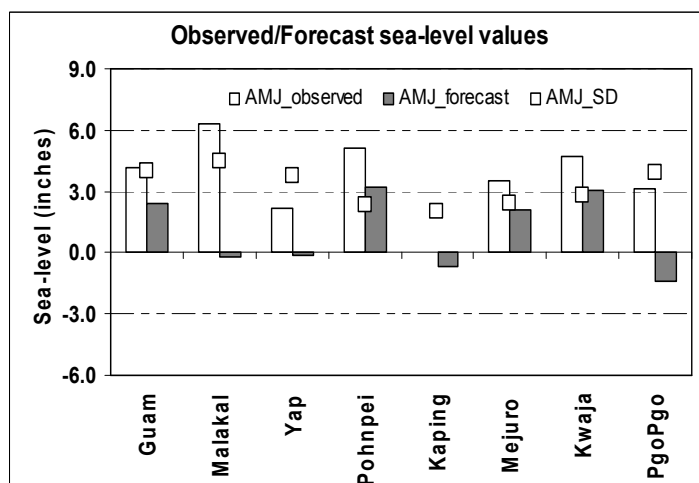
**Table 2: Monthly observed max/mean sea-level deviations in inches (year to year standard deviation in parentheses)**

Tide Gauge Station	Monthly Mean Deviations <sup>1</sup>				Monthly Max Deviations <sup>2</sup>			
	Apr	May	June	Standard Deviations	Apr	May	June	Standard Deviations
Marianas, Guam	+2.9	+4.4	+5.2	(+3.7)	+15.9	+18.5	+20.5	(+3.9)
Malakal, Palau	+2.9	+5.9	+10.1	(+4.0)	+36.5	+38.6	+42.4	(+3.8)
Yap, FSM	-0.5	+2.7	+4.3	(+3.4)	+28.2	+26.6	+28.3	(+4.0)
Chuuk, FSM	*	*	*	(*)	*	*	*	(*)
Pohnpei, FSM	+7.9	+7.3	*	(+2.2)	+35.3	+35.0	*	(+2.7)
Kapingamarangi, FSM	*	*	*	(+2.8)	*	*	*	(+3.1)
Majuro, RMI	+5.8	+4.7	*	(+1.8)	+43.2	+39.9	*	(+2.9)
Kwajalein, RMI	+4.9	+4.6	+4.7	(+2.3)	+39.2	+38.8	+39.3	(+2.7)
Pago Pago, American Samoa	+2.2	+2.4	+4.7	(+3.7)	+24.0	+23.2	+25.9	(+4.2)
Honolulu, Hawai'i	-3.1	-1.9	-0.5	(+1.8)	+14.4	+17.5	+18.5	(+1.9)
Hilo, Hawai'i	-2.6	-0.5	-1.1	(+2.0)	+18.1	+21.1	+20.8	(+2.4)

**Note:** (-) indicates negative deviation (fall from the mean) and (+) indicates positive deviation (rise from the mean); \* indicates data not available; Standard deviations describe how widely spread the values are in the dataset. See Table 1 for other notes.

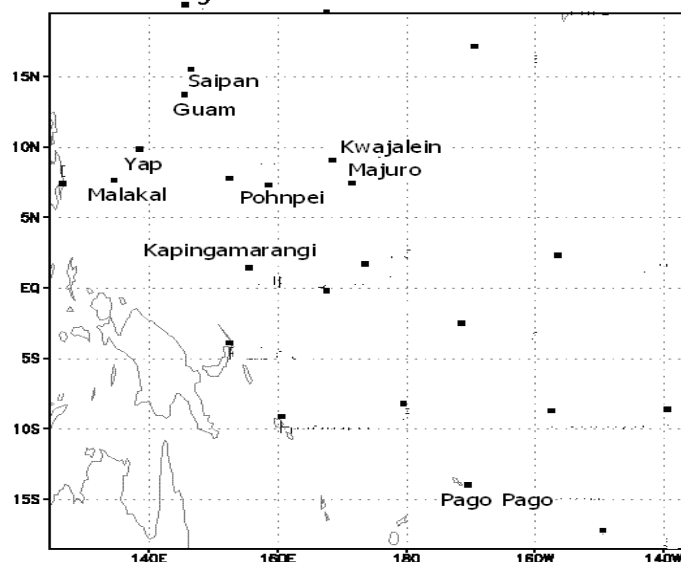
**Remarks:** As compared to May 2010, the monthly mean sea level in June 2010, recorded a rise in most of the north Pacific stations (i.e., Guam, Palau, Yap, and Pohnpei). In the south Pacific, Pago Pago also recorded a rise in sea level. The rise in Malakal is quite significant. Yap also recorded considerable rise. The monthly maximum recorded slightly higher than normal in most stations. Again in Palau and Yap, the maximum is considerably higher than normal. The sea level in Palau and Yap responded differently than Guam and other Micronesia locations because these two stations are in a different regime of the dynamic sea level.

## (iii) Forecast Verification (Seasonal Mean) for AMJ 2010



**Figure 1:** The observed and forecast values for the previous season AMJ is presented above. Forecasts were in general skillful; Malakal and Yap displayed a different picture, where a positive deviation was recorded despite negative forecast.

## Tide Gauge Stations



**Figure 2:** Locations of the US-Affiliated Pacific Islands tide gauge stations.

# Pacific ENSO Update

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## Excerpts from El Niño/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

Issued by NOAA NWS Climate Prediction Center - 8 July 2010

[http://www.cpc.noaa.gov/products/analysis\\_monitoring/enso\\_advisory/index.shtml](http://www.cpc.noaa.gov/products/analysis_monitoring/enso_advisory/index.shtml)

### ENSO Alert System Status: **La Niña Watch**

**Synopsis: La Niña conditions are expected to develop in July-August 2010.**

During June 2010, sea surface temperature (SST) anomalies continued to decrease across the equatorial Pacific Ocean, with negative anomalies expanding across the central and eastern Pacific. While the rate of decrease slowed during June, all of the Niño indices were cooler compared to the previous month. The subsurface heat content (average temperatures in the upper 300m of the ocean) also remained below-average during the month. Subsurface temperature anomalies became increasingly negative in the east-central equatorial Pacific and extended to the surface across the eastern half of the basin. Also during June, enhanced convection persisted over Indonesia, while the area of suppressed convection strengthened and expanded westward over the western and central equatorial Pacific. Enhanced low-level easterly trade winds and anomalous upper-level westerly winds prevailed over the western and central equatorial Pacific. Collectively, these oceanic and atmospheric anomalies reflect developing La Niña conditions.

The majority of models now predict La Niña conditions (SST anomalies less than or equal to  $-0.5^{\circ}\text{C}$  in the Niño-3.4 region) to develop during June-August and to continue through early 2011. Confidence in this outcome is reinforced by the recent performance of the NCEP Climate Forecast System (CFS), the large reservoir of colder-than-average subsurface water, and signs of coupling with the atmospheric circulation. Therefore, La Niña conditions are likely to develop during July-August 2010.

This discussion is a consolidated effort of the National Oceanic and Atmospheric Administration (NOAA), NOAA's National Weather Service, and their funded institutions. Oceanic and atmospheric conditions are updated weekly on the Climate Prediction Center web site (El Niño/La Niña Current Conditions and Expert Discussions). Forecasts for the evolution of El Niño/La Niña are updated monthly in the Forecast Forum section of CPC's Climate Diagnostics Bulletin. To receive an e-mail notification when the monthly ENSO Diagnostic Discussions are released, please send an e-mail message to: [ncep.list.enso-update@noaa.gov](mailto:ncep.list.enso-update@noaa.gov).

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The Pacific ENSO Update is a bulletin of the Pacific El Niño-Southern Oscillation (ENSO) Applications Climate (PEAC) Center. PEAC conducts research & produces information products on climate variability related to the ENSO climate cycle in the U.S.-Affiliated Pacific Islands (USAPI). This bulletin is intended to supply information for the benefit of those involved in such climate-sensitive sectors as civil defense, resource management, and developmental planning in the various jurisdictions of the USAPI.

The Pacific ENSO Update is produced quarterly both online and in hard copy, with additional special reports on important changes in ENSO conditions as needed. For more information about this issue please contact the editor at [peac@noaa.gov](mailto:peac@noaa.gov) or at the address listed below.

PEAC is part of the Weather Forecast Office (WFO) Honolulu's mission and roles/responsibilities. All oversight and direction for PEAC is provided by the Weather Forecast Office Honolulu in collaboration with the Joint Institute for Marine and Atmospheric Research (JIMAR) at the University of Hawai'i. Publication of the Pacific ENSO Update is supported by the National Oceanic and Atmospheric Administration (NOAA), National Weather Service-Pacific Region Climate Services. The views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA, any of its sub-agencies, or cooperating organizations.

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